

## Summary

**Title:** The effectiveness of applying the Sling shot device in the barbell bench press.

**Key words:** resistance training, training equipment, internal movement structure, electromyography, myotonometry

In the aspect of improving strength, developing maximum power or stimulating muscle hypertrophy of the upper body, which are important factors in both recreational and competitive training, the most frequently used exercise for training, testing or research purposes is the barbell bench press (Stastny et al., 2017). The structure of the barbell bench press movement has been extensively described in contemporary literature (Król & Gołaś, 2017; Lehman, 2005; Saeterbakken et al., 2017; Stastny et al., 2017; M. Wilk et al., 2019). However, there is a research gap concerning the impact of using training accessories on strength and muscle activity, more and more often used to improve sports performance (Godawa et al., 2012; P. A. Swinton et al., 2009). An accessory incorporating elastic resistance, which significantly affects the kinematics of the barbell bench press, is the "Sling Shot" (SS). The SS, made of two sleeves put on around the elbows connected by an elastic material, performs a similar function to a specialized shirt used in the bench press. Nonetheless, this device is a modern alternative, willingly implemented in the training routine, due to the ease of putting on and using, which allows user to work with supramaximal loads in the full range of motion by providing additional elastic energy and intensifying the stretch-shortening cycle (Ferland & Comtois, 2019).

The three empirical papers presented in this dissertation aimed at evaluating the effectiveness of the SS device based on the internal and external structure of the movement. Due to the characteristics of the equipment and its current use, the key aspect was to determine the influence of SlingShot in terms of muscle strength development using the barbell bench press. In the available, sparse literature on this issue, significant gaps can be noticed, which have been covered in the presented work, such as the lack of analysis of the parameters of both sides of the body and asymmetry, the lack of independent measurements of the one-repetition maximum test 1RM test or the omission of the influence of device on strength endurance and its manifestations, taking into account various external loads. The main purpose of the presented series of researches was to assess the impact of the Sling Shot device on the internal and external structure of the movement, where two of the studies were aimed at analyzing surface electromyography (sEMG) activity in various conditions of the lying barbell bench press, and the third of them was aimed at determining changes in the external structure and asymmetry

using myotonometry. It could be hypothesized that as a result of flexible support and unloading of the certain movement phase, the use of Sling Shot would affect muscle activity and interlimb asymmetry, while increasing the ability to generate strength, power and strength endurance of the subjects.

In each of the studies, the Sling Shot device was used, taking into account various conditions of muscle work, while at the same time relying on modern measuring equipment such as Noraxon TyleMyo 2400, MyotonPRO or GymAware Powertool, to assess the internal and external structure of movement. The subjects, with a certain minimum experience in resistance training, performed planned procedures based on a randomized crossover design, aimed at comparing the parameters of the barbell bench press in different working conditions. In each case, the experimental sessions were preceded by a familiarization session, where each activity within the study was preceded by a general and specialized warm-up, performed at the same time of day. In the first study, the results showed a significant effect of SlingShot on the pattern of muscle activity of bench press, causing a decrease in activity with an unchanged external load. Moreover, the difference in the results between the control protocol bench press and the SlingShot assisted bench press increased with increasing external load. The second paper confirmed the necessity of analyzing both sides of the body through significant differences in muscle activity. The use of SlingShot resulted in an increase in the activity of the non-dominant limb, while the increase in load resulted in a decrease in the asymmetry of the activity pattern. A third study, which included myotonometric measurements and effort to volitional refusal, points to the need for a separate assessment of maximal strength levels when using SlingShot in exercise and training programs. An independent measurement of 1RM and a correspondingly higher external load is required to fully utilize the device. The SlingShot can also be successfully used in increasing training volume to stimulate muscular endurance and local hypertrophy, alongside rising non-dominant limb involvement during the bench press exercise.